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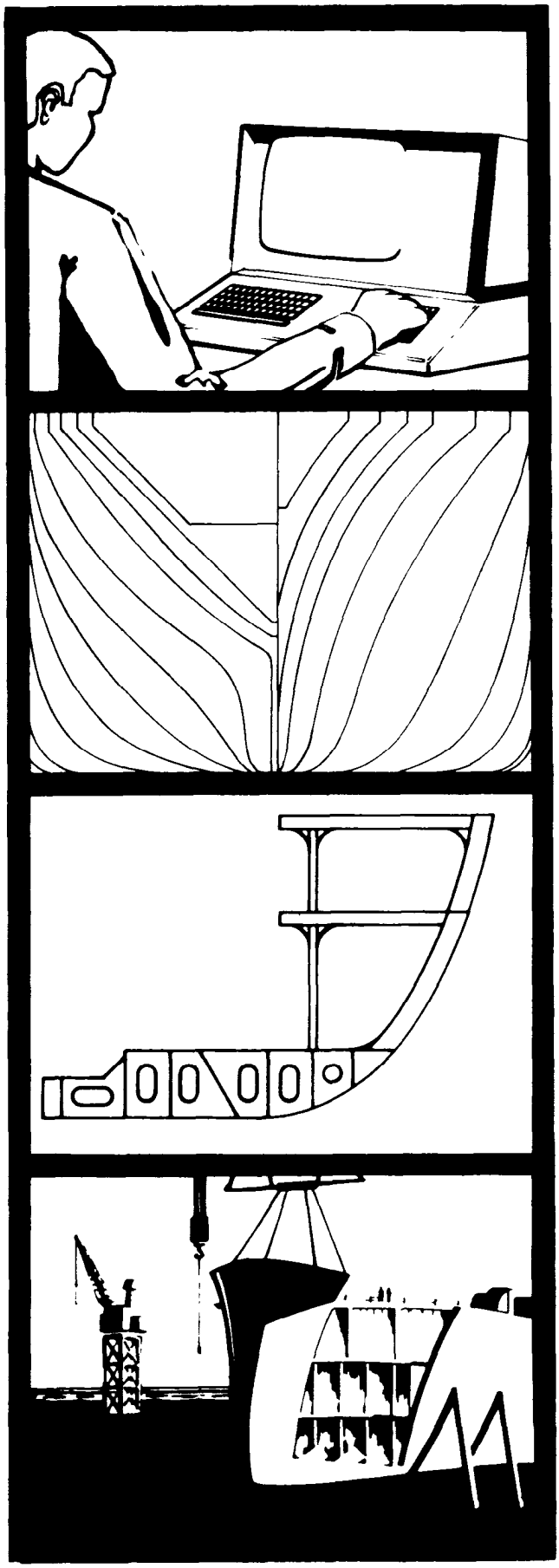

R ESEARCH
AND
E NGINEERING
FOR
A UTOMATION
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P RODUCTIVITY
IN
S HIPBUILDING

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THE AVONDALE PIPE SHOP: PREPARING FOR PRODUCTION

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PIPE SHOP MANAGEMENT SYSTEM

The Pipe Shop Management System was designed to meet the following objectives:

1) To provide a Manufacturing System that would be tightly coupled with the CADAM System.

2) To provide a total system that would assist in the smooth operation of the Pipe Shop.

3) To provide a System that would increase Productivity in the Pipe Shop and the Avondale functions supporting the production of pipe spools.

To meet the above overall objectives, it was decided, after an evaluation of the functions, that the IBM COPICS software packages would be used. COPICS is an interactive data base manufacturing software system using terminals. Of the available eleven (11) packages, the following were used for their functionality and applicability:

- Bill of Materials Batch Utilities
- Bill of Materials On-Line
- Inventory Accounting
- Advanced,Functions MRP
- Shop Order Release
- Routings
- Facilities
- CORMES

The three (3) packages that are available but are not being used:

- Forecasting
- Costing
- Customer Order

These software packages had to assist Avondale in meeting requirements determined by the feasibility study.

The requirements that these software packages had to assist Avondale meeting, as determined by the feasibility study were:

1) To establish and maintain a current Bill of Material as originated by Engineering.

2) To determine how much material is needed of each raw type on what date.

3) To establish a means to maintain accurate inventories.

4) To produce a process or route sheet for each pipe detail that is to be produced.

5) To Schedule Pipe Details to be produced.

6) To produce a cutting list for Pipe details to be produced.

7) To produce a status of machine loads based on actual schedule of Pipe Details to be produced.

8) To provide location control for Pallet storage.

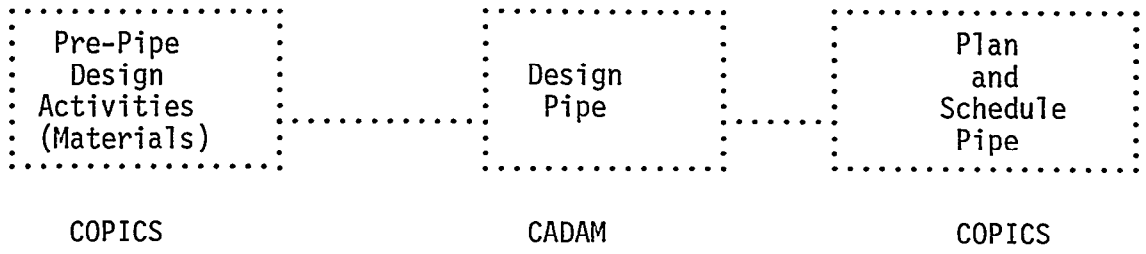


FIGURE A.

The feasibility design of the system, based upon the requirements, was to logically group all activities to be performed (Reference FIGURE A.). Pre-Pipe design activities consists of the requisition and ordering of materials, the assigning of pipe details to pallets, and the determination of the Master Erection Schedule (i.e., when all units, pallets, and pipe details should be complete for erection based upon launch date of ship).

The Design of the pipe is a CADAM function. This function receives input from and generates output to the COPICS system. The Planning and Scheduling of pipe detail is a COPICS function. The activities performed, as well as the everyday maintenance to keep the system in synchronization, is done using the standard COPICS (and in some cases modified) software.

MEETING THE OBJECTIVES

The following narratives describe the system interactions required to meet the three (3) objectives of the Pipe Shop Management System.

OBJECTIVE 1: To provide a Manufacturing System that would be tightly coupled with the CADAM System.

CADAM, the system installed at Avondale to design and produce Pipe Details (PD's), was installed prior to the COPICS decision. The system as installed produced a Pipe Detail and the associated Bill of Material (Reference Fig. 1 & Fig. 2).

Creating the drawing and the associated Bill of Materials has always been defined as an Engineering Function.. However, an additional function was assigned to Engineering to generate and produce data required for the COPICS System: that of creating the Process Plan or Routing for the Pipe Detail through the Pipe Shop.

Creating Routings is one of the functions provided by the COPICS software. However, creating the Drawing on the CADAM System and the Routings on the COPICS System proved akward. COPICS and CADAM are separate systems with no common interfaces. It was therefore decided that since Engineering was to perform both functions, that they would be done on the CADAM System. The results of the plotted output is shown in Fig. 3.

To produce this output, the PD is first generated. After the PD is complete with drawing, Bill of Material , and cut lengths, a menu item is selected to allow for the creation of the Process Plan. This creation is all performed using Light Pen Selection for the routing of each pipe section through the pipe shop for PD completion. The next work station is automatically calculated by the CADAM software. When the PD is plotted, the process plan is plotted also, as if one drawing (Fig. 3).

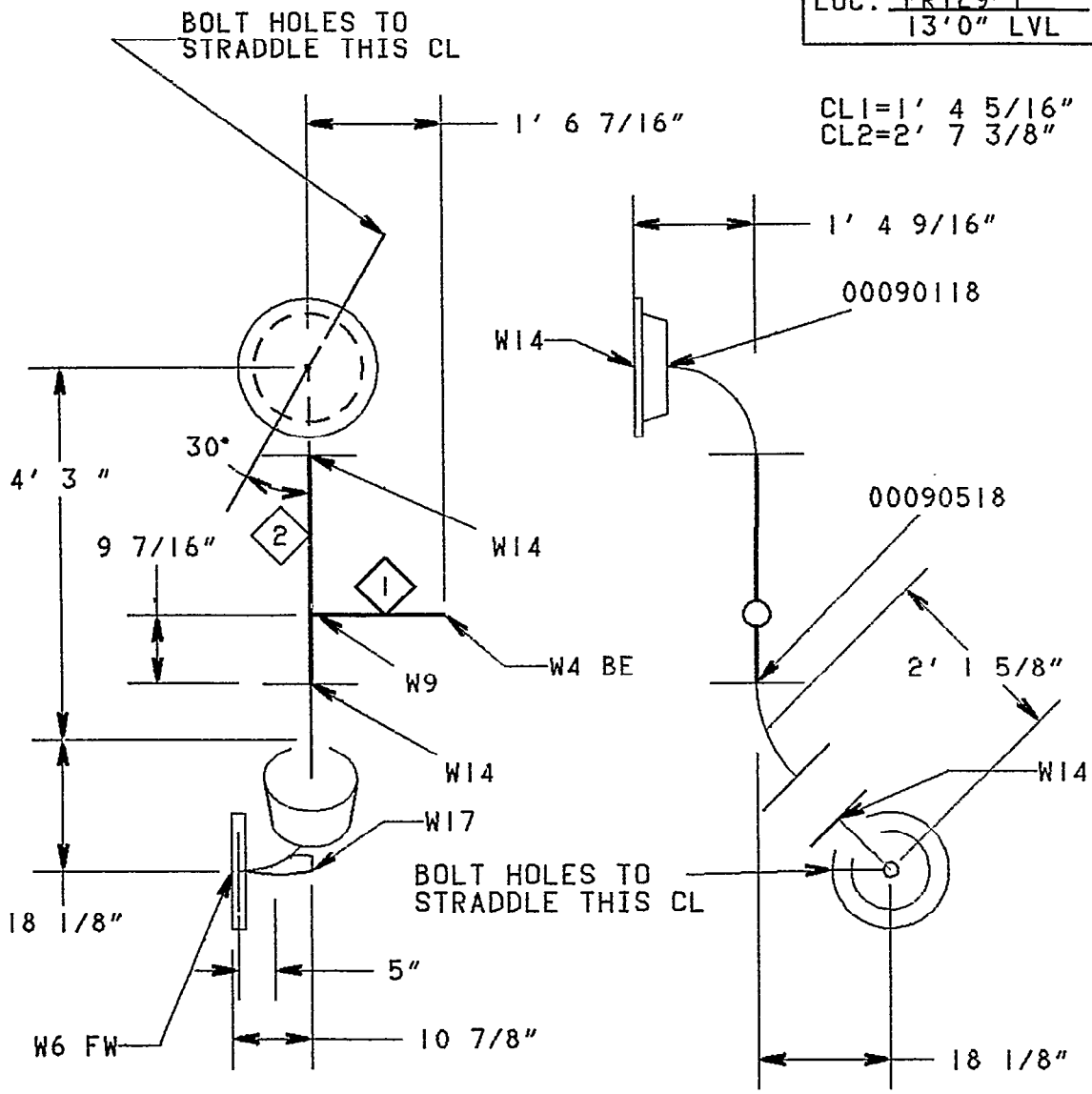
Data required for the COPICS Bill of Material and Routing System has now been created and prepared on the CADAM System. This data has attributes associated with it so that it can be extracted and formatted to be added to the COPICS DL/l data bases.

Figure B is a graphic representation of this activity. The B/M transactions and B/M Load and Maintenance programs use the existing COPICS code. Routing transactions and maintenance is new code required to update the Routing data base with routings for each PD through the Pipe Shop.

In addition, as new purchased items required for Pipe Fabrication are added to the Product Definition data base through COPICS, they will be extracted and added to the CADAM Pipe Catalog.

FIGURE 1.

P.D.NO. 4-12"
NO. REQD. 1
LOC. FR129-1
13'0" LVL



NOTE: FOR MAT'L SEE PAGE 8A

COST CODE	AVONDALE SHIPYARDS, INC. P.O. BOX 50280 NEW ORLEANS, LA. 70150	JOB NO. C9-215
	TITLE: MAIN ENGINE L.O. SUCT. STR. & PUMPS PACK UNIT-P/D	DWG NO. 45-006-817
		DWN R.L.
		REVISION 0

SHEET 8

FIGURE 2.

P.D.NO. 4-12"
NO. REQD. 1
LOC. FR129-1
13'0" LVL

00061318	PIPE STL SMLS STD ASTM A 53 GR B 12
00070117	FLANGE STL SLIP-ON 150 ASTM A105 GR I/II ANSI B16.5 RF 10
00071118	FLANGE STL WELD NECK 150 ASTM A105 GR I/II ANSI B16.5 STD BORE RF 12
00090117	ELL 90 STL BW STD SMLS ASTM A234 GR WPB ANSI B16.9 SR 10
00090118	ELL 90 STL BW STD SMLS ASTM A234 GR WPB ANSI B16.9 SR 12
00090518	ELL 45 STL BW STD SMLS ASTM A234 GR WPB ANSI B16.9 12
00120156	REDUCER STL BW STD ASTM A234 ANSI B16.9 CONC 12 X10
00100950	ELBOLET STL FORGED SW 3000 ASTM A105 GR II 36 -1 1/4 X 1/2

COST CODE	AVONDALE SHIPYARDS, INC. P.O. BOX 50280 NEW ORLEANS, LA. 70150	JOB NO. C9-215 DWG NO. 45-006-817
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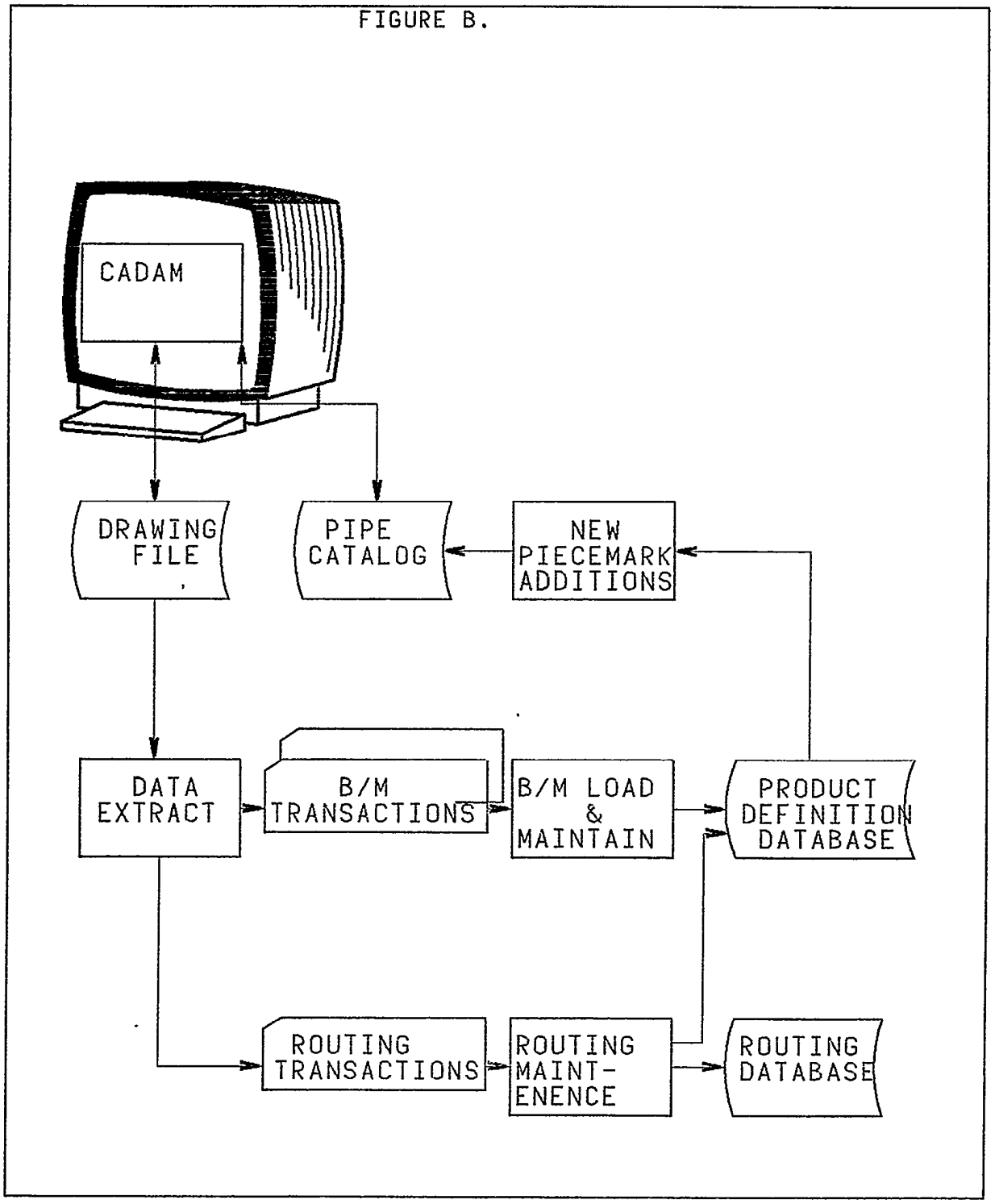
SHEET 8A

FIGURE 3.

10	CLEAN EXTERNAL	1	2
20	CLEAN INTERNAL	2	27
	00090118		
	00071118		
30	SUB SUB ASSEMBLY	27	28
40	SUB ASSEMBLY	28	27
	00061318		
	00100950		
50	SUB SUB ASSEMBLY	27	28
60	SUB ASSEMBLY	28	27
	00120156		
	00071118		
	00090518		
70	SUB SUB ASSEMBLY	27	28
80	SUB ASSEMBLY	28	29
	00100950		
	00120156		
	00090518		
	00090118		
	00090117		
	00071118		
	00070117		
	00061318		
90	X-RAY 1 1/2"-10"	29	31
100	TESTING STATION	31	

FIGURE B.


CADAM
DRAWING FILE
PIPE CATALOG
NEW PIECEMARK ADDITIONS
DATA EXTRACT
B/M TRANSACTIONS
B/M LOAD & MAINTAIN
PRODUCT DEFINITION DATABASE
ROUTING TRANSACTIONS
ROUTING MAINT-ENENCE
ROUTING DATABASE

OBJECTIVE 2: To provide a total system that would assist in the smooth operation of the Pipe Shop.

The standard COPICS System is used to plan and schedule material through the Shop. Some modifications are made to the advanced function material requirements planning system to provide for planning of PD materials by job number. Once the materials are planned, the PD's are scheduled into the pipe shop for fabrication. The Master Schedule input to the MRP run is based upon the following structure:

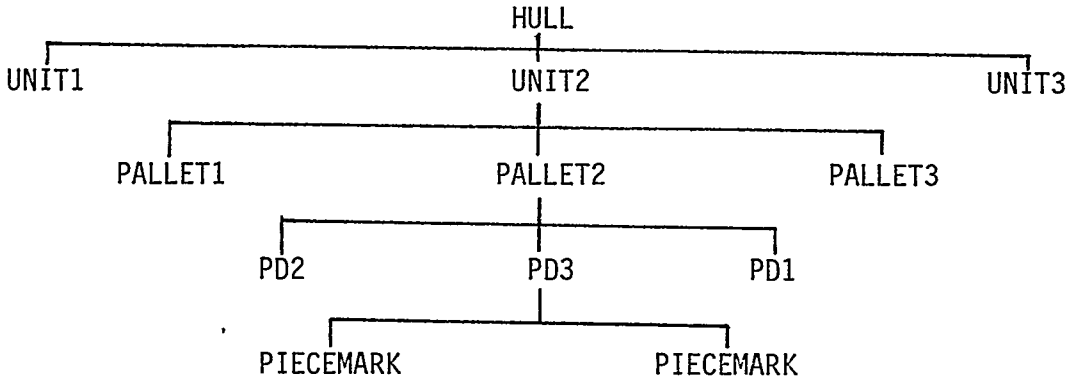


FIGURE C.

The hull and the scheduled completion date are entered into the master schedule. Completion of the MRP Run then establishes need dates for the piecemark or pipe materials. When shop order release is run, shop orders to produce pipe are opened and released and move orders for pallets are issued. In addition, reports will be generated to assist shop personnel in:

- Having material (i.e., valves, flanges, etc.) other than pipe at each work station to complete each days pipe production.

- Having visibility as to the PD's required over a user specified horizon.

- Analyzing shop loads based on PD Production.

- Tracking PD's completed over a specific time period.

- Palletizing PD requirement, and the storage and retrieval of pallets to meet erection schedule.

- Load pipe storage rack to meet daily production of PD's.

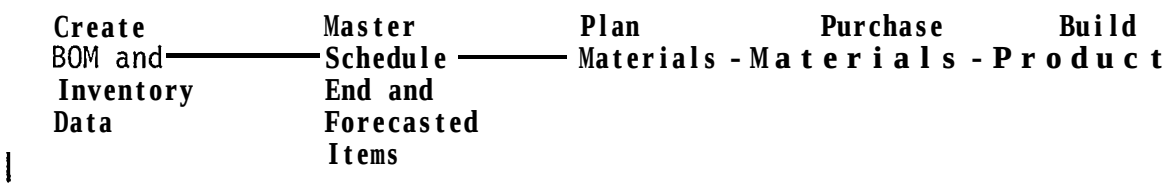
- Complete PD's required over a user specified time period (i.e., day, week, month).

Other reports will be generated to allow the shop to know its status each day and what production is required in the future. As time progresses and the reports are used in the production of pipe, a natural progression will be to use the abreviated screens of the COPICS on line system instead of reports to further enhance the operation of the shop.

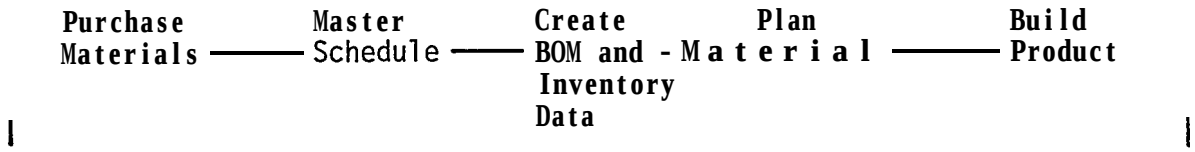
OBJECTIVE 3: To provide a system that would increase productivity in the pipe shop and the Avondale functions supporting the production of PD.

The primary function supporting the production of pipe is the acquisition of material and to insure its availability prior to production date. One problem associated with using the COPICS software was the start to end cycle and where in the cycle to purchase the material.

The COPICS software assumes the cycle will be as follows:



The Avondale cycle is:



The first cut at material purchase is made very early in the cycle for four (4) reasons:

1) The long lead time associated with some materials.

2) The paperwork involved to produce a purchase order.

3) The paper work flow.

4) The checks and balances imposed on the user to insure that too much material is not being ordered. In addition, all material was being ordered at the same time whether it was needed or not.

The installation of COPICS at Avondale Shipyards provided the following areas of productivity gains in the pipe shop.

The COPICS System for Avondale allows for the creation of a material plan when the requests first exist. However, the material will not be ordered until needed. The material will be monitored against job requirements. When PD's are entered into the System, the material will then be tracked against the PD for the job. By using the facilities of COPICS, the workload to order and monitor the material should be drastically reduced. A 50% increase in productivity in that department would not be unreasonable.

The second area that should experience an increase in productivity should be the production scheduling department. This department expends considerable effort in determining which PD's should be ready when to meet the erection schedule. By adhering to the rules of the master schedule input as shown in Figure E, the prefabrication erection schedule output will be automatic, thus elimination of the manual effort expended to generate and maintain this schedule.

The third area that will show an increase in productivity is that of determining the routing of the PD through the Pipe Shop. By creation of the Routing on the CADAM System and having this routing available at the beginning of the PD production cycle, no special skill will be required on production day to route the PD. Any employee that can read will be able to insure that the PD is routed correctly and fabricated.